

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

COPY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

To:
DAVID SILVERSTEIN
ANDOVER-IP-LAW
44 PARK STREET, SUITE 300
ANDOVER, MA 01810

Date of mailing
(day/month/year) **05 JUL 2005**

Applicant's or agent's file reference
TSY-001PC

FOR FURTHER ACTION See paragraphs 1 and 4 below

International application No.
PCT/US05/03792

International filing date
(day/month/year) 04 February 2005 (04.02.2005)

Applicant
DAVID TSAY

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, within **20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/ US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (703) 305-3230

Authorized officer

Basia Ridley

Telephone No. (571) 272-1700

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JUL 11 2005

(See notes on accompanying sheet)

Form PCT/ISA/220 (January 2004)

BY: *[Signature]*

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference TSY-001PC	FOR FURTHER ACTION <small>see Form PCT/ISA/220 as well as, where applicable, item 5 below.</small>	
International application No. PCT/US05/03792	International filing date (<i>day/month/year</i>) 04 February 2005 (04.02.2005)	(Earliest) Priority Date (<i>day/month/year</i>) 06 February 2004 (06.02.2004)
Applicant DAVID TSAY		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (See Box No. II)

3. ☐ Unity of invention is lacking (See Box No. III)

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the drawings to be published with the abstract is Figure No. 2A

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/03792

Box IV TEXT OF THE ABSTRACT (Continuation of Item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

The abstract is too long (PCT Rule 8.1(b)). The abstract must be less than 150 words, or 200 words when no figure is to be published.

NEW ABSTRACT

Hydrogen generating method and apparatus. The apparatus comprises a mixed phase protonic-electron conducting cermet membrane (2), wherein said membrane is coated with porous metal or composite catalyst (1) effective to decompose hydrocarbon and water reactants into a hydrogen rich syngas at elevated temperature and pressure. The hydrogen ions are continuously withdrawn in situ by diffusing them through the mixed phase conducting cermet membrane (2) to the second membrane side where the hydrogen ions can be reconstituted into molecular hydrogen with a supply of electrons. The method favorably shifts the equilibrium of steam reforming and water gas shift reaction by use of a single stage, high efficiency and high purity membrane reactor.

International application No.

PCT/US05/03792

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : C01B 3/32

US CL : 48/127.9, 128, 198.3, 198.7; 422/211

US CL : 48/127.9, 128, 198.3, 198.7, 422/211
According to International Patent Classification (IPC) or to both national classification and IPC

B. **FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 48/127.9, 128, 198.3, 198.7; 422/211

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,278,268 A (PFEFFERLE, JR) 11 October 1966 (11.10.1966)	1-20
A	US 3,847,672 A (TROCCIOLA et al.) 12 November 1974 (12.11.1974)	1-20
A	US 5,229,102 A (MINET et al.) 20 July 1993 (20.07.1993)	1-20
A	US 5,861,137 A (EDLUND) 19 January 1999 (19.01.1999)	1-20

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"p" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 June 2005 (23.06.2005)

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US

Commissioner for Patents

Commissioner
P.O. Box 1450

Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Date of mailing of the international search report

Authorized officer

Basia Ridley

Telephone No. (571) 272-1700

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: DAVID SILVERSTEIN ANDOVER-IP-LAW 44 PARK STREET, SUITE 300 ANDOVER, MA 01810
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Date of mailing (day/month/year)	05 JUL 2005
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Applicant's or agent's file reference TSY-001PC
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FOR FURTHER ACTION See paragraph 2 below
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International application No. PCT/US05/03792	International filing date (day/month/year) 04 February 2005 (04.02.2005)	Priority date (day/month/year) 06 February 2004 (06.02.2004)
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International Patent Classification (IPC) or both national classification and IPC IPC(7): C01B 3/32 and US Cl.: 48/127.9, 128, 198.3, 198.7; 422/211

Applicant DAVID TSAY

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1. This opinion contains indications relating to the following items:

BY:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Basia Ridley Telephone No. (571) 272-1700
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J. Whitfield
for

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US05/03792

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US05/03792

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>1-20</u> YES Claims <u>NONE</u> NO
Inventive step (IS)	Claims <u>1-20</u> YES Claims <u>NONE</u> NO
Industrial applicability (IA)	Claims <u>1-20</u> YES Claims <u>NONE</u> NO

2. Citations and explanations:

Claims 1-15 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest an apparatus for producing hydrogen comprising a reformation chamber including a feed inlet to an interior region of the chamber, a product outlet from the interior region of the chamber and a protonic-electron conducting cermet membrane having a first side in the interior region of the chamber and a second side outside the interior region of the chamber; a porous layer of a reformation catalyst supported by and/or adhered to or adjacent to said first side of the cermet membrane which permits diffusion of ionic hydrogen from said first side thereof through the membrane to said second side thereof, and a collection region of chamber on the second side of the membrane where the hydrogen ions can be reconstituted into molecular hydrogen with a supply of electrons.

Claims 16-20 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a method for producing hydrogen comprising the steps of contacting an alcohol or hydrocarbon feed with a reformation catalyst under reformation temperature and reformation pressure conditions, said reformation catalyst being coated along or bonded to a surface on a first side of a mixed phase protonic-electron conducting cermet membrane capable of diffusing hydrogen ions; diffusing at least a portion of the hydrogen ions produced by the feed decomposition through the cermet membrane to a second side of the membrane, and combining hydrogen ions diffused through the membrane with electrons to reconstitute molecular hydrogen on the second side of the membrane.

Claims 1-20 meet criteria of industrial applicability under PCT Article 33(4) because claimed system can be used to provide fuel for fuel cell and therefore for electric power production.